REMARKS

Applicants appreciate the Examiner's thorough consideration provided the present application. Claims 1-13 are now present in the application. Claims 1-13 have been amended. Claim 1 is independent. Reconsideration of this application, as amended, is respectfully requested.

Claim Rejections Under 35 U.S.C. §§ 102 & 103

Claims 1-6 and 8-13 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Khosravi, U.S. Patent No. 7,200,146. Claim 7 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Khosravi in view of Oprescu, U.S. Patent No. 5,784,557. These rejections are respectfully traversed.

Independent claim 1 recites a combination of elements including "[a] method for deadlock free altering of a network routing in a network with flow control on the link level, said network routing is from a first routing function Rold, defining an established connection between a plurality of communication input ports Il,..,In and output ports Ol,..,Om, in a network element, to a second routing function Rnew, defining an new connection between the said input and output ports, for execution by the network element for transmitting and receiving data packets, said method comprising: (1) for each input port Ii, performing the following steps: (1a) applying the first routing function Rold for the input port, (1b) receiving a token on an input port Ii, (1c) applying the second routing function Rnew for the input port Ii, (1d) forwarding data packets to every output port Oj associated with the input port Ii according to the second routing function Rnew, provided that the output port Oj has transmitted the token, (2) for each output port Oj,

performing the following steps; (2a) determining if the token has been received on all input ports associated with the output port Oj according to the first routing function Rold, (2b) transmitting the token on the output port Oj when the token has been received on all said input ports." Applicants respectfully submit that the above combination of steps as set forth in amended independent claim 1 is not disclosed nor suggested by the references relied on by the Examiner.

The Examiner construed the deadlock free routing as a state in which no communication is possible. Applicants respectfully disagree. In fact, a deadlock situation in network routing is a situation that occurs when a set of packets cannot proceed in the network. This situation can occur in networks that do not drop data packets, *i.e.,* in networks with flow control on the link level.

The following description explains what a network deadlock is, and how it can be avoided through the routing strategy according to the present invention. In FIG. 1 shown below, there are four Compute Nodes (CN1 through CN4). Each of these is connected to a switch 10. The switches are interconnected through bidirectional links with a channel in each direction. For simplicity, only one unidirectional channel of each link has been included in the drawing. The channels that are illustrated are the ones in the clockwise direction. Each channel has a buffer on the sending side, and a smaller buffer on the receiving side.

Assume now that all Compute Nodes simultaneously send data packets to the Compute Node positioned diagonally opposite itself. Assume also that the routing strategy of the switches is to use the clockwise direction for all data packets whose destination is diagonally opposite. FIG. 1 shows that CN1 has sent data packets 15, filling up the buffers of the upper horizontal channel, CN2 has sent data packets 25 filling up the buffers of the rightmost vertical channel, etc.

In this situation, no data packets can proceed any further to their destination, because all "next-hop" buffers are already full. *This is what is called a network deadlock in the present application*. If a switch was allowed to throw away packets, it would also be able to resolve the deadlock.

In FIG. 2 shown below, the routing function has been changed. As shown in FIG. 2, all data packets travel horizontally first, and then vertically. It can be seen that CN2 and CN4 will no longer use the channels in the same way. Instead, they will actually use the channels in the counter clockwise, *i.e.* the direction that is not drawn. In this system, the packets do arrive at their destination, and the packet deadlock is avoided.

Here, *routing packets horizontally first, and then vertically is so-called deadlock free*. This is due to the fact that the channel dependency graph is acyclic. The channel dependency graph is the graph where the channels are considered as nodes, and there is a dependency between channel A and channel B if there are packets that according to the routing algorithm will use channel B after channel A. In the figures, the channel dependencies are illustrated by dotted arrows. More importantly, when routing is horizontal first (FIG. 2), the channel dependency graph is acyclic, whereas the physical topology still contains a cycle. This illustrates why *pruning dependency graphs is not the same as pruning topology* in Oprescu, which is argued in the Amendment dated September 27, 2007. In the example illustrated here, all links are still in use in "horizontal first" routing, because all communication with nearest neighbor will use the shortest path. The topology has therefore not been pruned. However, the channel dependency graph will have been pruned, so that it is acyclic.

Applicants respectfully submit that the present invention is to alter the routing function of the network used in the above example from "horizontal first, and then vertical" to "*vertical first and then horizontal*". Each of these two routing algorithms is deadlock free, and has a cycle free channel dependency graph. If the transition between the two routing functions is done in a wrong order, the network may get into a transitory state where all routing is clockwise – and therefore may deadlock. The present invention guarantees that such unwanted and fatal transitory states never appear. Those features are clearly absent from Khosravi. In fact, Khosravi discloses a method for reconfiguring internal FEs (switches) in an IP router as a consequence of external IP-route changes. *Since IP networks may drop packets in Khosravi, deadlock is not even an issue for Khosravi.*

Accordingly, neither of the references utilized by the Examiner individually or in combination teaches or suggests the limitations of amended independent claim 1 or its dependent claims. Therefore, Applicants respectfully submit that claim 1 and its dependent claims clearly define over the teachings of the references relied on by the Examiner.

Accordingly, reconsideration and withdrawal of the rejections under 35 U.S.C. §§ 102 and 103 are respectfully requested.

CONCLUSION

It is believed that a full and complete response has been made to the Office Action, and that as such, the Examiner is respectfully requested to send the application to Issue.

In the event there are any matters remaining in this application, the Examiner is invited to contact the undersigned at (703) 205-8000 in the Washington, D.C. area.

Pursuant to 37 C.F.R. §§ 1.17 and 1.136(a), Applicants respectfully petition for a two (2) month extension of time for filing a response in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

Dated: April 10, 2008

Respectfully submitted,

By ____________________

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